Information Management in Healthcare – gaps and opportunities

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Abstract

Healthcare is one of the single largest areas of expenditure in many countries, and rapidly growing. There are increasing pressures resulting from the ageing of populations, consumer demand, new treatments and shortages of both professional and informal carers. Safety and quality of care is a major driver to improve management of health information which is often fragmented both within and between most healthcare providers. This paper reports on issues of information management in healthcare, advances in eHealth, and ways of addressing the increasing challenges in healthcare through ICT; with a particular focus on the author's experiences in the Australian healthcare system.

1. Introduction

Information and communication technology (ICT) is a key tool for quality healthcare, needs-assessment, service planning, integrated care planning, disease management, delivery of care and evaluation of delivery effectiveness and outcomes. Many healthcare organisations have disparate and incomplete systems and lack of integration is a common theme. There are databases with duplicate data held elsewhere in organizations and often complicated reporting systems that are unconnected to information needs for care planning and delivery.

A challenge for healthcare planners is to obtain the greatest population health improvement for the available resources. Populations are never homogenous in terms of health risks, service needs and capacity to access services. Therefore, establishing baseline data for different groups of populations is the first step in evidence-based needs analysis.

In an ideal world, planners and policy-makers would draw from a knowledge-base to identify at-risk groups, those with a low health status or other factors indicating the need for healthcare intervention. The knowledge-base would inform the selection of intervention based upon research evidence or international best-practice. At the point of care, effectiveness would be optimised by the clinician having readily available all relevant information including the patient's history, research evidence and best-practice guidelines. Evaluation would inform whether the intervention was effective both for the condition as well as for the target-group health status and whether different action was appropriate.

An issue is the need to link clinicians with research databases to assist them in providing evidence-based care. Better mechanisms are required to link the world's most up-to-date research and models of best practice with planners and clinicians. There is also a need to complete the loop and ensure all interventions are evaluated. Otherwise we cannot be sure we are not repeating habitual practice that may be ineffective or even damaging. A database that allows care delivery to be evaluated by health outcome is essential.

2. Objective

The objective of this paper is to discuss the healthcare environment in Australia, the current state of information management and the further potential that ICT offers. Suggestions for moving forward are offered to enable the healthcare industry and its consumers to enjoy the convenience and other benefits that ICT has provided in other industries.

3. Methods

The research for this paper involved accessing the Australian national statistical databases of the Australian Institute of Health and Welfare (AIHW) and the Australian Bureau of Statistics (ABS). The AIHW is the government's national centre for health and related statistics and research. This identified key issues which were explored in detail with key stakeholders including officials from selected state and federal government departments. The ABS is the national statistical authority. The author also worked at planning and policy roles in both federal and state levels of health administration and is familiar with key issues. The author is the Director of CAAIR (Collaboration for Ageing & Aged-care Informatics Research) that focuses on technology assessment evaluation, barriers to adoption, economic benefits and policy and strategy of ICT in health and aged-care. The experiences of the CAAIR research program have also informed this paper.

4. Background – health in Australia

An aspect of the environment for healthcare includes the demographic changes that are now common across many countries. These include increased life expectancy, reduced mortality, decreased family size, delayed first child and rapid ageing of populations. Healthcare funding is complex in many countries with combinations of government funding, private health insurance, government-provided services and

private services including for-profit and not-for-profit. The environment in Australia is discussed as an example.

Life expectancy
A boy born in Australia 2005 was expected to live to 78.5 years, while a girl would be expected to live to 83.3 years [1]. Life expectancy is not uniform across population groups within Australia. Indigenous people have a life expectancy about 20 years less than the rest of the Australian population. Life expectancy varies by socio-economic groups and by region. Life expectancy at birth in the Northern Territory is lower by 5.3 and 6.5 years for males and females respectively, compared with the national average. These differences reflect the higher death rates of the Indigenous populations, which make up close to 30% of the Northern Territory population [1].

Fertility
Since 1961, when each woman on average had 3.6 babies, total fertility rates have declined to 1.75 births per woman in 2006 [2]. This is notably below the replacement level of 2.1 babies per woman, and reflects a trend in fertility to drop below the replacement level in the developed and some developing countries.

Mortality
Cardiovascular disease is the leading cause of death among Australians accounting for 39% of all deaths. Coronary heart disease was the major cardiovascular cause of death accounting for 53% of all such deaths, followed by stroke (25%), heart failure (5%) and peripheral vascular disease (5%). Cardiovascular mortality is higher among Indigenous Australians, in rural areas of the country and among socio-economically disadvantaged groups [1]. There has been a considerable decline (around 68%) in cardiovascular death rates. Coronary heart disease death rates have been declining faster than death rates from stroke. Declines in death rates for coronary heart disease and stroke have been influenced by reductions in the prevalence of some risk factors (high levels of blood pressure, tobacco smoking and saturated fat intake) and in medical interventions such as counselling, drug use, emergency care, medical and surgical treatment, and follow-up care. These gains have been achieved despite a significant increase in the prevalence of overweight and declines in physical activity levels.

Ageing
Australia is one of the more rapidly ageing countries with 13% of the population currently over 65. There is an expectation of increasing pressures on hospital services, shortages of carers and increasing consumer demand as well as an increasing availability of assistive technologies to support care deliver, particularly in home settings. This is compounded by the predications that the percentage increases in people with disabilities will dramatically grow between 2006 and 2031 [3].

Funding
Health expenditure in Australia includes expenditure funded by the Australian, state and territory governments, by private health insurance and by individuals and families. Total expenditure on health in 2004-05 was AU$87.3b compared with expenditure of $79.1b the previous year. This represented an average rate of health expenditure in 2004-05 of $4,319 per person. In 2004-05 governments combined provided just over two-thirds (68%) of the total funding for health expenditure. Health expenditure grew at an average annual rate of 5.3% between 1994-95 and 2004-05. In 2004-05 total health expenditure as a proportion of GDP (gross domestic product) was 9.8% compared with 8.1% in 1994-95 [2]. Healthcare funding and governance is complicated. The federal government manages and funds medications, consultations with clinicians in private practice and diagnostic services. The 6 state and 2 territory governments manage and fund services (including medications and diagnostic services) in the public hospitals which they own and operate. In addition there are private hospitals and war veterans and their families may have their care supported by a separate federal Department of Veterans' Affairs. All Australian working residents pay a compulsory national health insurance scheme Medicare and can also have private insurance. The main collector of taxation is the federal government which allocates funds to the state and territory governments which pays part of the costs of public hospitals and other services. There is occasionally a debate about the needs for rationalizing governance and funding with the expectation that it needs to be simplified.

Health information
Personal health information is largely managed on a provider basis and there is no unique patient identifier, no centralized data repository, limited sharing or integration of databases. Components of an individual's personal health care records can be found across the files of each provider that a patient has received services from including hospital, private practitioner, pharmacy or other. An attempt to introduce a national identity number in 1985 was defeated politically [4]. The national Medicare system retains data covering those services the federal government has provided an individual with funding for but these records are not integrated with information systems at the point-of-care.

Reduced and delayed fertility, increased longevity and reduced mortality are increasing the percentages of older people in populations. This is expected to increase demand for support and for all types of care. There is a need to explore the use of information technology both for helping people maintain their

health and independence as well as in supporting health services in meeting the increased pressures.

5. e-Health

A stimulus to investment in information systems has been the advent of e-commerce involving on-line trading and on-line relationship management, which has been embraced by industries and sectors around the world and is already changing the nature of business activity and customer service. Healthcare is lagging in its application of e-commerce or e-Health. e-Health refers primarily to e-business in healthcare. That is, the use of the Internet, Intranet or Extranet for on-line transaction, interaction with knowledge base, and integrated customer service delivery. e-Health offers potential benefits to patients and care providers, improvements in healthcare planning and resource management, and both clinical benefits and financial savings through electronic transactions and better information management.

e-Health can be expected to ultimately deliver patient benefits including illness prevention, earlier illness intervention, and reduction in conditions becoming acute. Doctors will receive electronic notification of patient discharges, online patient referrals and view the status of their hospitalised patients. Clinicians will have services like laboratory results arrive automatically with alerts about abnormal results so that they can recall the patient for follow-up treatment. When a patient presents at a point of service, whether that is in community or hospital care, the treating clinician will have access to the patient's up-to-date and fully integrated care plan. Added value services may include links to intelligent data-warehouses, knowledge-based systems that can assist in diagnosis and treatment protocols. e-Health would also allow patients to be better informed about their conditions and to be more actively involved in management of their own conditions.

There is some use of B2B (Business to business) e-Health in that most private physicians receive pathology results and diagnostic imaging reports electronically. Most private diagnostic practices digitize images and send them electronically for reporting before providing results electronically to the ordering physician. Hospitals are largely controlled by state Departments of Health and within some of these there is integration of information relating to services patients have received within their facilities. The Queensland Department of Health operates 160 hospitals ranging from large tertiary to small remote hospitals; rehabilitation; community care and 20 aged care nursing homes. It operates a very extensive telehealth network with 500 nodes across an area 2000x1000 kilometres extending to remote locations. There is increasing availability of services across the telehealth network.

B2C (Business to consumer) is happening in terms of consumer access to health information through the Internet and the massive amount of information available. However there are few examples of health providers allowing their patients to interact with their databases in the way that, for example, airlines or banks encourage us to do most of our transactions with them on-line.

Quality data

Rather than just being an aid to delivery, quality data needs to drive resource allocation and trigger healthcare interventions. A knowledge base should alert planners and clinicians about the evidence-base for a planned intervention. It should equip the direct-care unit with the information it needs at the point of care delivery. The link to complete the information loop is evaluation. The knowledge base needs to be dynamic and receive feedback about an intervention, what impact it will have on the target community and whether the intervention delivers the desired outcome. A health knowledge base would be the hub for the planning, delivery and evaluation of care. It should store information about communities, about the areas or strata that are unsafe and should be targeted. If you are responsible for managing healthcare resources, you need to know that your service's efforts are making a difference to your communities in terms of health outcomes and to know that the resources invested will deliver the best value for investment compared with alternatives.

Just as e-commerce has highlighted the need for integrated quality data about customers, e-Health offers a vision for improved quality and availability of patient data in healthcare. e-Health would facilitate more rapid transfer of data, such as laboratory results, physician records and hospital records between health professionals. This should assist in speeding up the delivery of appropriate medical interventions and so aid in more effective and rapid recovery. A by-product would include reduced lost or missing paper work, a complete audit trail of all electronic documents and information databases of community health status, risk factors, treatment best practice and information on outcomes and the effectiveness of healthcare interventions.

Communication technology

Communication technologies need to be designed to meet the requirements of the highly mobile populations and the mobile work practices of many clinicians. While there have been significant improvements in health as with most other services, there is still the need for development. Australia's population is highly mobile. There is a tendency for patients to 'shop around' for doctor's services and not always visit the same doctor. There is currently little sharing of patient information between doctors even if they work in the same practice. Laboratory results that one doctor requested are not always

available to the next doctor, similarly with radiology images and reports. In addition, patients are not necessarily the best source of information about their care history, particularly amongst the elderly who may be forgetful.

Wireless and mobile technology

Bedside terminals, units that live on mobile trolleys and the like are expensive and have been disappointing in their adoption. Wireless LANs, linked PDAs (Personal Digital Assistants) and other hand-held devices offer promise to overcome the fundamental problem of the physical user interface. While hand held devices hold more promise, there is still the issue of being encumbered with carrying the device while also needing to push a dressing trolley, medication trolley or to carry other equipment. Hand held devices in this environment need to be robust as they are more prone to damage and loss. Even if we solve the problem of a user-friendly mobile device, there is still the issue of data presentation. While much of the world's health research is available across the Internet, with the average consultation lasting only a short time, clinicians are unlikely to have the time required to search for this information.

Access to health information is already a significant component of existing Internet traffic. Mobile access will facilitate remote monitoring, follow up, prevention, remote assistance, diagnostics, m-prescriptions and patient access to their records. Caregivers will be able to integrate the information at the bedside or point-of-care with those existing in the system to deliver the best care. Simple, flexible, personalized and secure connectivity for doctors, nurses, administrative staff and patients is essential for achieving this objective. There have been iterations of ever more sophisticated tablet-PCs and there is a strong likelihood that this technology will be pervasive.

6. Discussion

There is interest in Australia as in many other countries in better enabling frail older people and the chronically ill to receive care in their own homes and delay or avoid moving into institutional care. There are prototype Smart Homes as research or demonstrators of environments equipped with sensors and other technologies to enable the elderly remain independent in their own homes and receive care [5]. In some countries there are projects that go beyond research or demonstration and aim to implement assistive home technologies on a broad scale. In South Australia a system of referrals from hospital admission to home care is in use [6].

Patients receiving care in the home express a higher level of satisfaction than patients receiving care in hospitals [7]. Caplan, Coconis and Woods [8] found that treatment in a Hospital in the Home arrangement resulted in less confusion and fewer bowel and bladder problems for older patients.

There is potential for technology to enhance the safety and independence of frail older people, enable access to quality care services and to extend their ability to remain in their own homes. Intelligent monitors can keep a continuous watch on patients' vital signs, activity patterns, their safety and security. The technology can monitor indicators of their state of health, provide alerts to events such as falls, and give early warnings of potential problems. The technology can notice changes in activities and alert a carer. Monitoring devices can be more accurate guides to the health risks such as a heart attack than are the patient's symptoms, providing advance warnings and reducing unnecessary emergency callouts [9].

A 2005 report [10] identified four key areas where digital technologies can be used to improve the lives of the aged, disabled and chronically ill. These include self management of healthcare in home settings with enormous potential savings and other benefits. Home automation will enhance security, safety and independence at home. This will help maintain quality of life and decrease the demand for carer support hours. Communication technologies will provide important benefits for people whose mobility is limited, or who live alone. Finally the various home automation and digital technologies can benefit the aged and the disabled, improving their quality of life by enhancing their independence. Technology has the potential to extend their physical independence, so they can stay for longer in their homes. It gives them a more dignified life, and it saves public and private money.

Education and learning are regarded importantly by seniors as assisting them to more fully engage in a rapidly changing society. Seniors being actively engaged has positive health benefits. Cruikshank [11] suggest that one of the ways older people can self-reinvent themselves is through education and learning, but that institutions are not yet particularly supportive in terms of the provision of access to technology and modes of education despite the rhetoric of life-long learning.

The number and sophistication of available technologies continues to increase. There is a need for research into adoption issues, return on investment, realisation of benefits, integration and interoperability. Indications are there are gaps in the range of technologies and particularly in intelligent software and interfacing [12].

7. Conclusion

While there has been adoption of sophisticated medical equipment and patient information management systems, healthcare is yet to embrace e-business in the form of B2C (business to consumer).

Healthcare is characterized by fragmentation posing challenges for integrated care and for sharing of patient information. For most of healthcare there is a low level of use of IT compared with some other industries, a low level of integration of information between primary care, secondary care, community care and aged care. Most intra-entity and inter-entity transactions remain paper-based. There is limited information available at the point of care and data is often incomplete for measuring outcomes and health gain. There are however some exciting initiatives and technologies to address these shortcomings. e-Health and knowledge-management offer an exciting vision for an information-driven service, providing quality data for planning, delivery and evaluation and reducing adverse health events.

Information and communication technology is important tool for improving management and bringing better health outcomes in modern society. E-Health, quality data, new wireless and mobile technology provide promise for reducing medical practitioners' workload, reducing mistakes and improving care outcomes. Healthcare is unusual in that there is extensive use of sophisticated technologies within hospitals and other facilities but little in terms of integration of patient information between healthcare providers. Direct patient interaction with their care providers through email or on-line access to databases is still quite rare.

The ageing tsunami may be a trigger for the introduction of technology that will have far reaching impacts across healthcare. It may stimulate greater use of home care supported by technologies and a shift of focus towards chronic illness and health maintenance.

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